3.5 / 3~~6~~7

$$y = \left(\frac{x-5}{2x+1}\right)^3$$

$$\frac{dy}{dx} = y' = 3\left(\frac{x-5}{2x+1}\right)^2 \frac{d}{dx}\left(\frac{x-5}{2x+1}\right)$$

$$= 3\left(\frac{x-5}{2x+1}\right)^2 \left(\frac{(1)(2x+1)-(x-5)(2)}{(2x+1)^2}\right)$$

$$= 3\left(\frac{x-5}{2x+1}\right)^2 \left(\frac{2x+1-(2x-10)}{(2x+1)^2}\right)$$

$$= 3\left(\frac{x-5}{2x+1}\right)^2 \left(\frac{11}{(2x+1)^2}\right) = \frac{33(x-5)^2}{(2x+1)^4}$$

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3.5/39 $y = \dfrac{(2x+3)^3}{(4x^2-1)^8}$

$\frac{d}{dx}\left((2x+3)^3\right) = 3(2x+3)^2\frac{d}{dx}(2x+3)$

$y' = \dfrac{\frac{d}{dx}\left((2x+3)^3\right)(4x^2-1)^8 - (2x+3)^3\frac{d}{dx}\left((4x^2-1)^8\right)}{\left((4x^2-1)^8\right)^2}$

$\frac{d}{dx}(4x^2-1)$

$\frac{d}{dx}\left((4x^2-1)^8\right) = 8(4x^2-1)^7\frac{d}{dx}(4x^2-1)$

$= \dfrac{\left(3(2x+3)^2(2)\right)(4x^2-1)^8 - (2x+3)^3\left(8(4x^2-1)^7(8x)\right)}{(4x^2-1)^{16}}$

$= \dfrac{(2x+3)^2(4x^2-1)^7\left[6(4x^2-1) - (2x+3)(8)(8x)\right]}{(4x^2-1)^{16}}$

$= \dfrac{(2x+3)^2(4x^2-1)^7\left[24x^2-6-(128x^2+192x)\right]}{(4x^2-1)^{16}}$

$= \dfrac{(2x+3)^2}{(4x^2-1)^9}\left(-104x^2-192x-6\right)$

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3.5/35

$$y = (5x+8)^{13}(x^3+7x)^{12}$$

$$y' = \frac{d}{dx}\left((5x+8)^{13}\right)(x^3+7x)^{12} + (5x+8)^{13}\frac{d}{dx}\left((x^3+7x)^{12}\right)$$

$$= \left(13(5x+8)^{12}\frac{d}{dx}(5x+8)\right)(x^3+7x)^{12} + (5x+8)^{13}\left(12(x^3+7x)^{11}\frac{d}{dx}(x^3+7x)\right)$$

$$= \left(13(5x+8)^{12}(5)\right)(x^3+7x)^{12} + (5x+8)^{13}\left(12(x^3+7x)^{11}(3x^2+7)\right)$$

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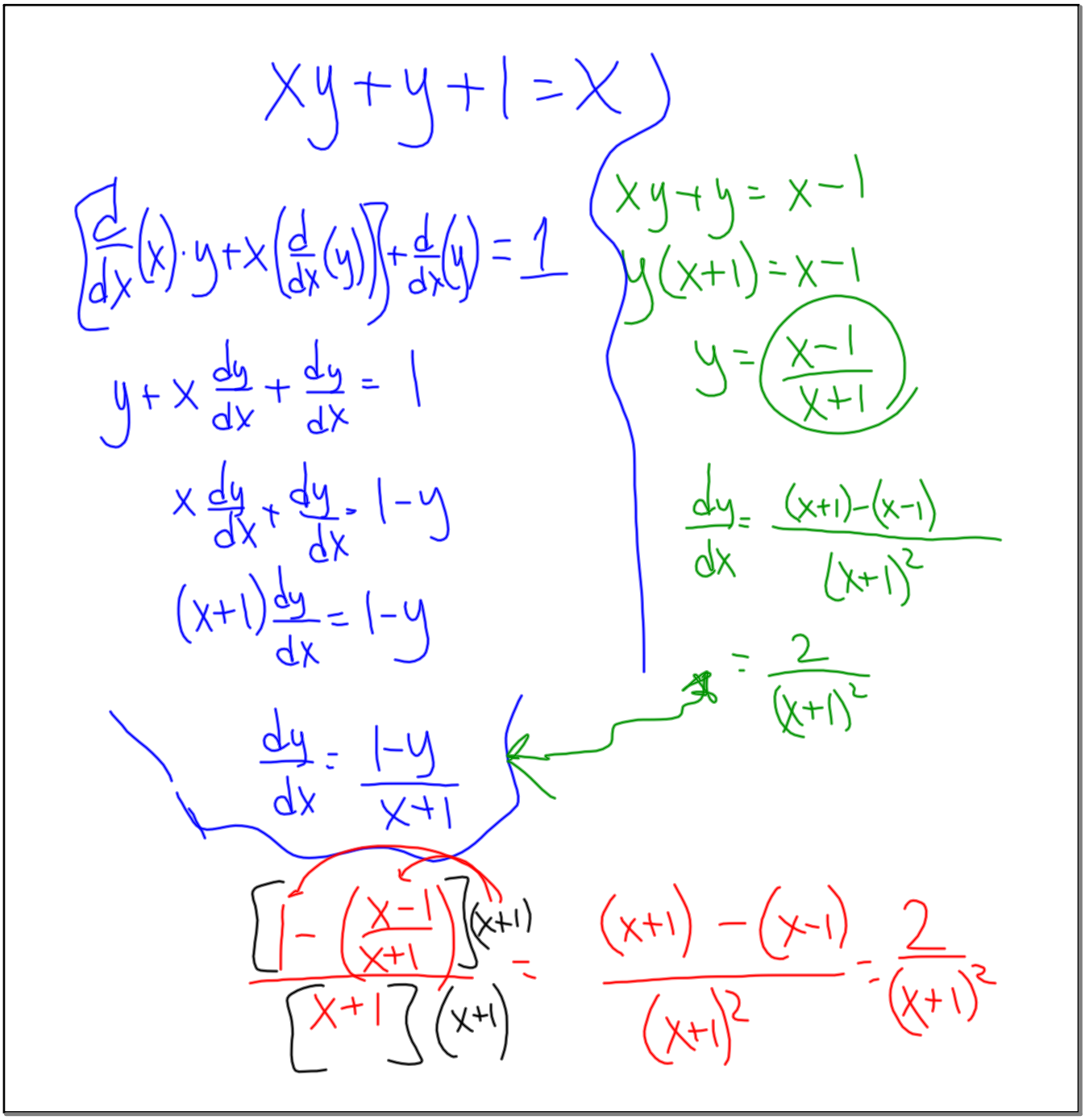
3.6 Implicit Differentiation

$$f(x) = (5x+8)^{13}(x^3+7x)^{12}$$

$$f(x) = (5x+8)^{13}\, y$$

$$f'(x) = \frac{d}{dx}\left((5x+8)^{13}\right)\cdot y + (5x+8)^{13}\frac{d}{dx}(y)$$

$$= \left\{13(5x+8)^{12}(5)\right\}\cdot y + (5x+8)^{13}\frac{dy}{dx}$$


$xy+y+1=x$
$\frac{d}{dx}(x)\cdot y + x\left(\frac{d}{dx}(y)\right) + \frac{d}{dx}(y) = 1$
$y + x\frac{dy}{dx} + \frac{dy}{dx} = 1$
$x\frac{dy}{dx} + \frac{dy}{dx} = 1-y$
$(x+1)\frac{dy}{dx} = 1-y$
$\frac{dy}{dx} = \frac{1-y}{x+1}$
$xy+y = x-1$
$y(x+1) = x-1$
$y = \frac{x-1}{x+1}$
$\frac{dy}{dx} = \frac{(x+1)-(x-1)}{(x+1)^2}$
$= \frac{2}{(x+1)^2}$
$\frac{\left[1-\left(\frac{x-1}{x+1}\right)\right](x+1)}{[x+1](x+1)} =$
$\frac{(x+1)-(x-1)}{(x+1)^2} = \frac{2}{(x+1)^2}$

Function defined explicitly

You know

$y =$ blah - blah - blah $- x - x$

Function defined implicitly

$x^2 + y^2 = 1$

$y^2 = 1 - x^2$ → either $y = \sqrt{1-x^2}$

or $y = -\sqrt{1-x^2}$

$$x^2+y^2=1$$

$$2x+2y\frac{dy}{dx}=0$$

$$\frac{2y}{2y}\frac{dy}{dx}=\frac{-2x}{2y}$$

$$\frac{dy}{dx}=\frac{-2x}{2y}$$

$$\frac{dy}{dx}=\frac{-2x}{2y}=-\frac{x}{y}$$

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differentiate implicitly

$x^3 + y^3 = 3xy$ $(3x)(1y)$

$3x^2 + 3y^2 \frac{dy}{dx} = 3$

$f(x) = 3x \quad f'(x) = 3$

$g(x) = y \quad g'(x) = \frac{dy}{dx}$

$3x^2 + 3y^2 \frac{dy}{dx} = \left(3x \cdot \frac{dy}{dx}\right) + \left(y \cdot 3\right)$

$3y^2 \frac{dy}{dx} - \left(3x \cdot \frac{dy}{dx}\right) = 3y - 3x^2$

$\frac{dy}{dx}\left(3y^2 - 3x\right) = 3y - 3x^2$

$$\frac{dy}{dx} = \frac{3y - 3x^2}{3y^2 - 3x}$$

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